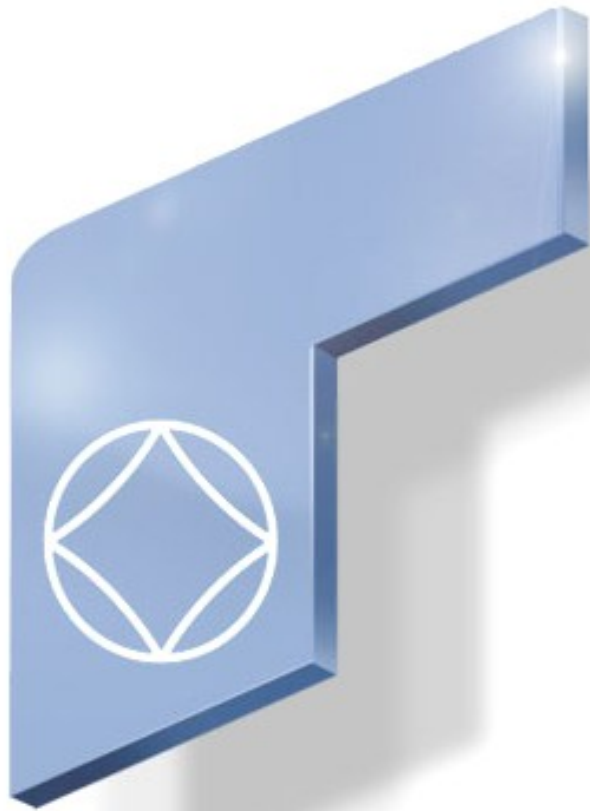




**RHEINMETALL
W&M**

MONARC - 155mm Artillery for Frigate Size Ships

Presentation to the

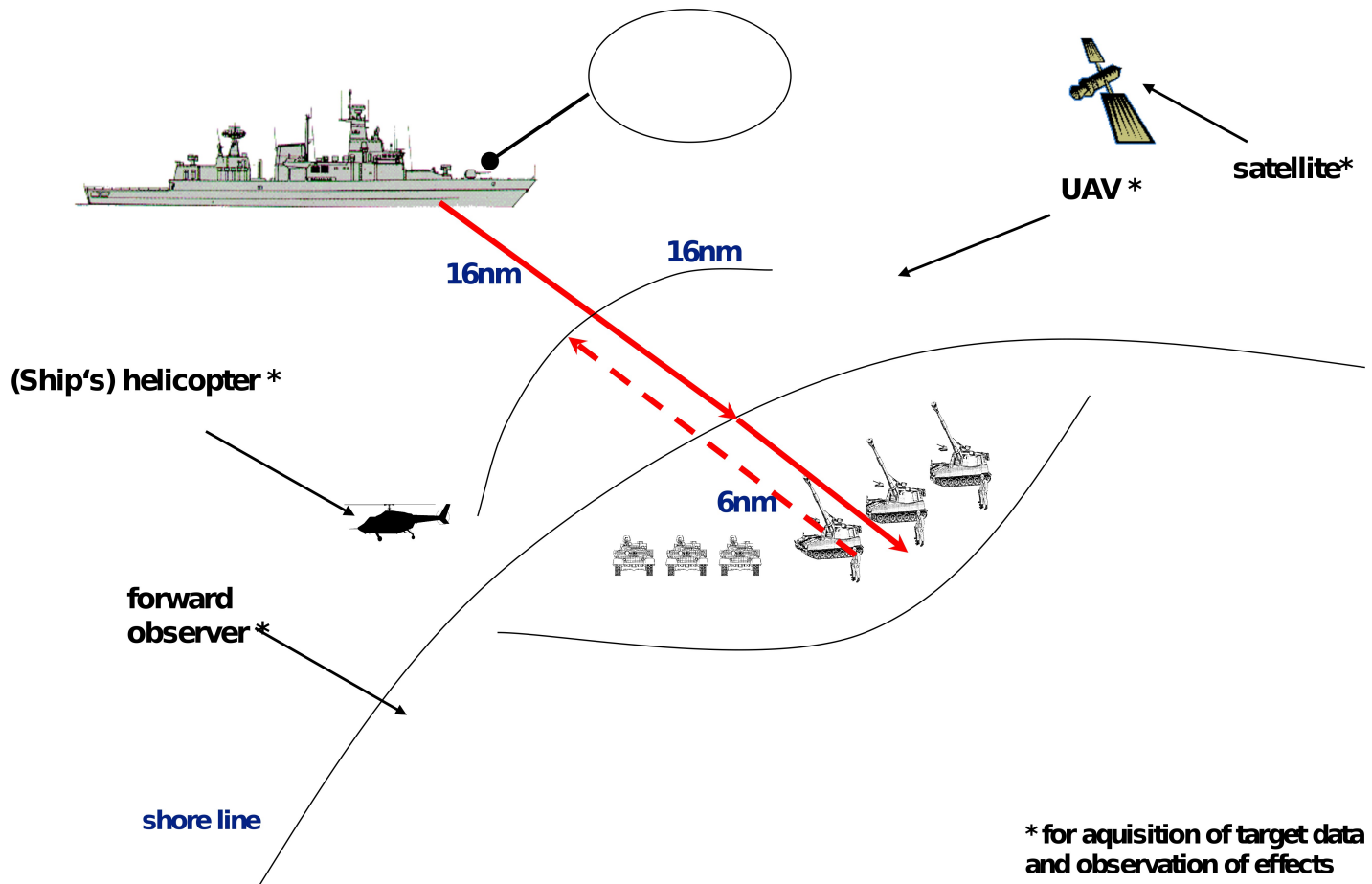
**39th Annual Gun & Ammunition
Missiles & Rockets
Symposium**

April 16th 2004

**by
Dr. Joseph Kruse
Director Business Development**

The Problem

Requirement for Naval Surface Fire Support



The Solution

**PzH 2000
155mm**



The Team

An initiative of

- the biggest German shipyard
- Europe's leading system contractor for armoured vehicles
- one of the world's most innovative suppliers for

ground forces equipment
Howaldtswerke Deutsche Werft AG



Rheinmetall W&M GmbH



Krauss-Maffei Wegmann GmbH & Co KG



RHEINMETALL
WAFFE MUNITION

The Initiative



The Project Group

MONARC[®] = MODular Naval ARtillery Concept

Common activity of the Companies

- **Howaldtswerke Deutsche Werft AG (HDW)**
- **Krauss-Maffei Wegmann GmbH & Co KG (KMW)**
- **Rheinmetall W&M GmbH (RWM)**

to provide NSFS capability with a low-cost solution by integrating the PzH 2000 turret on board of a frigate

First Ideas started on September 16th 2002

Presentation to German Navy Officials (BWB and MarA) on December 11th 2002 at HDW shipyard in Kiel

Modular Naval Artillery Concept 155mm

PzH 2000 onboard Frigate 124 “Hamburg”



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PzH 2000 onboard Frigate 124 “Hamburg”



PzH 2000 onboard Frigate 124 “Hamburg”



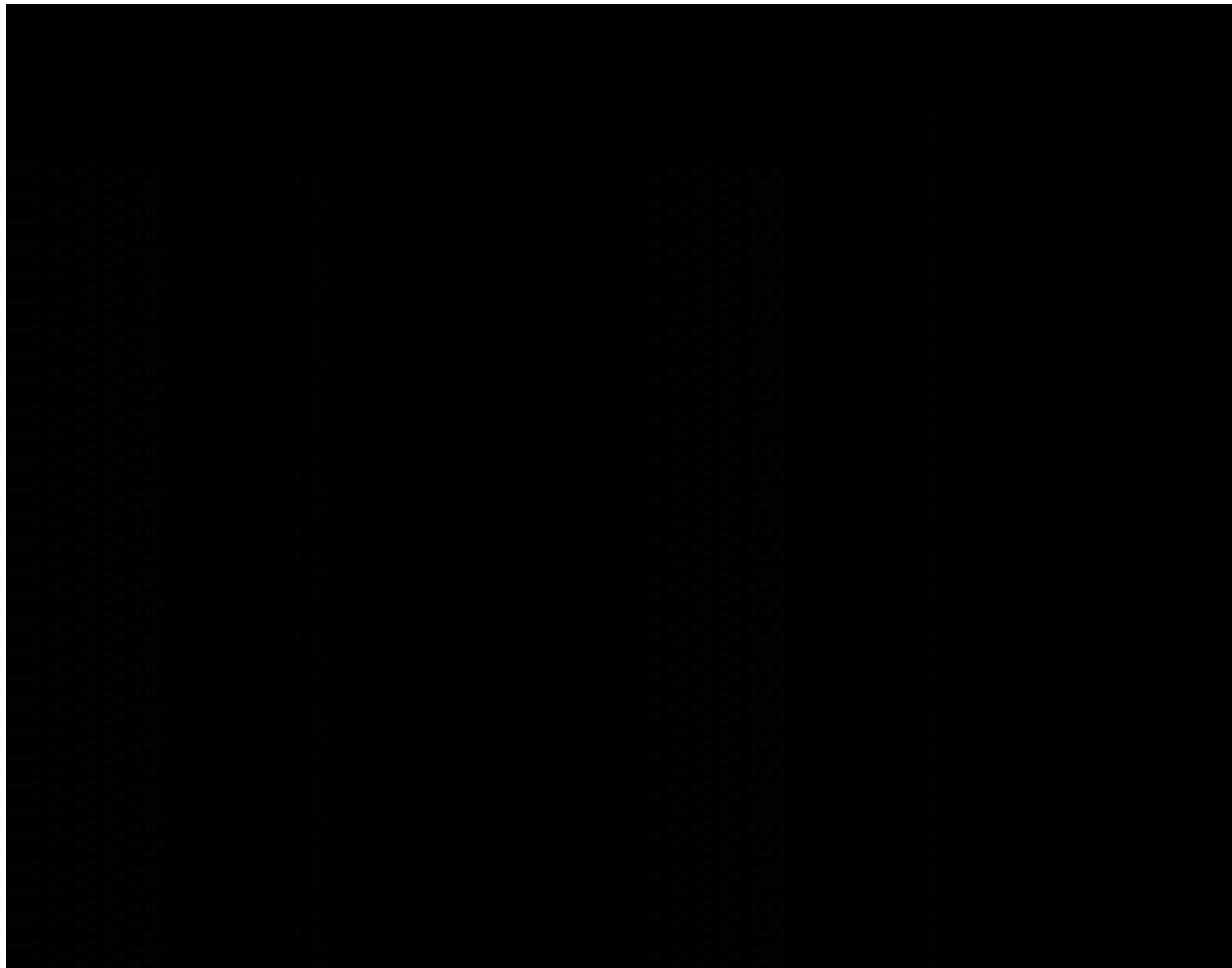
Modular Naval Artillery Concept 155mm

PzH 2000 onboard Frigate 124 “Hamburg”



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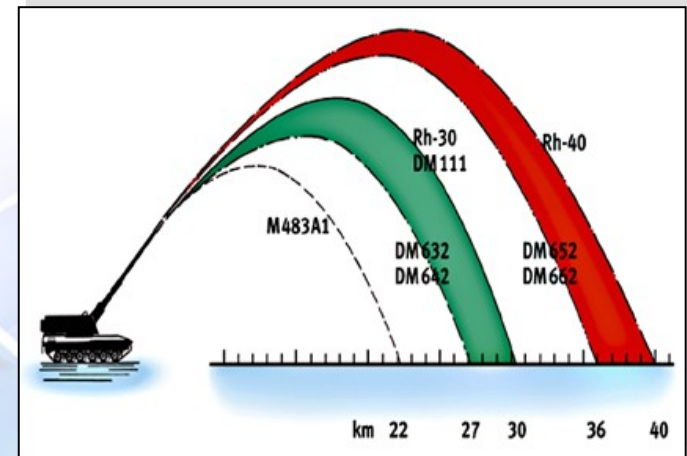




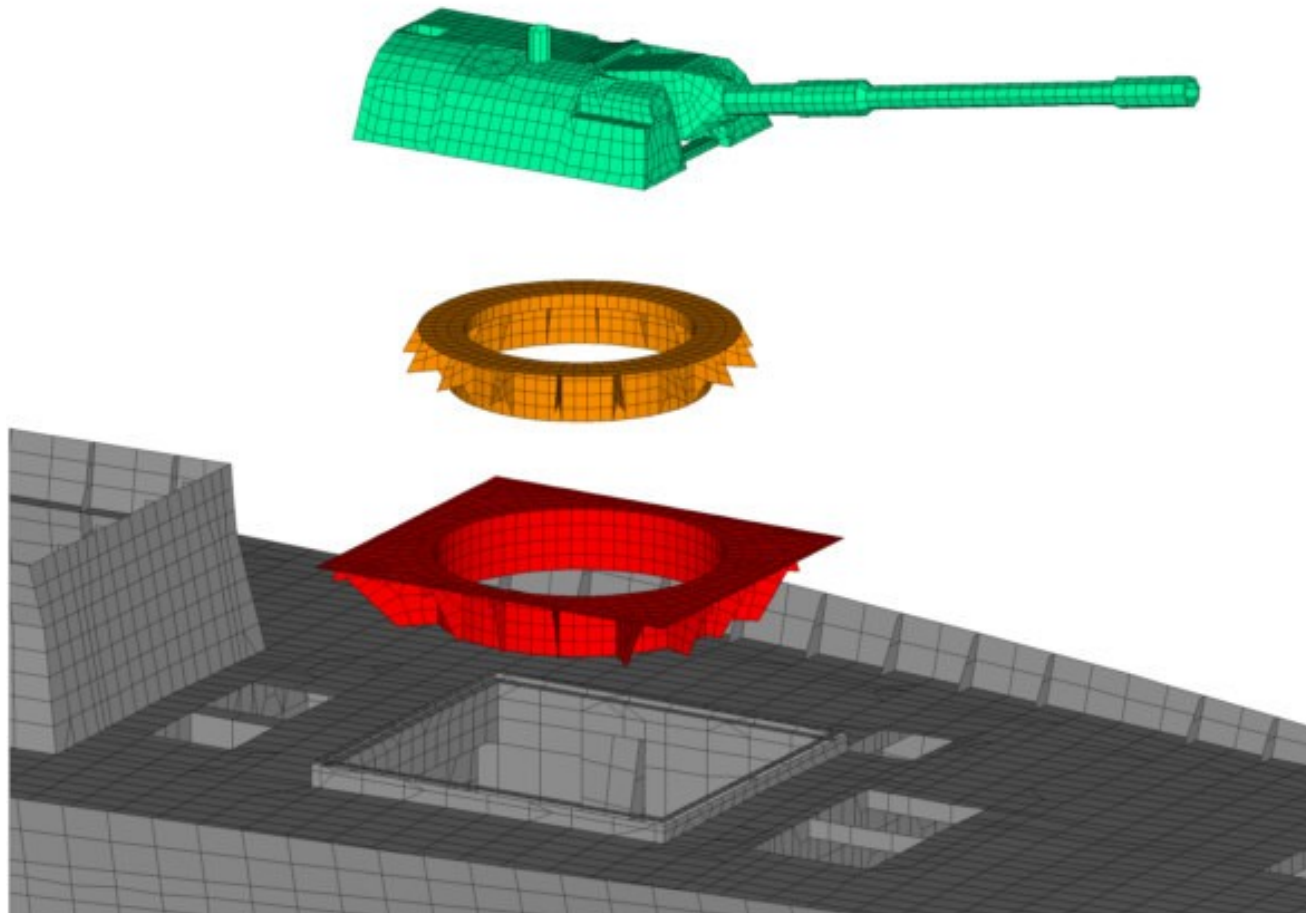
PzH 2000 Main Characteristics

Essential characteristics of the L52 gun:

- Long maximum effective range up to 40 km
- High rate of fire (3 rounds in less than ten seconds, 12 rounds in one minute proven)
- Modular propelling charge system, auto-matic primer magazine and automatic shell loading
- Long barrel life (demonstrated in live fire trials: > 2,500 with six charge modules, > 5,000 rounds with five modules)
- A balanced mix of ammunition covering accuracy and maximum



Integration onboard a ship



Integration onboard a ship



Integration onboard a ship

Mechanical Set-Up

- **No problem with weight or volume as the PzH turret mass is only 18t**
- **Recoil force management requires elastic mountings designed with respect to the ship's properties**
- **This ensures that the system can be retrofitted to existing ships with only minor conversion efforts**

Electrical Set-Up

- **Only 24V power supplies are needed from the ship's installations**

Validation of the Mounting



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Modular Naval Artillery Concept 155mm



Validation of the Mounting

- The elastic mountings for frigate type ships have been designed and manufactured
- In a firing test, on the Rheinmetall proving range in Unterlüß in June 2003, the expected results for these mountings were validated
- Measured forces and accelerations verified the concept of elastic mounting and provide the baseline for the integration of MONARC on any other practical type of ship
- Additional measurements of the muzzle report, provided the sound envelope needed to determine the obstacle contouring limits



Conclusion



- **In December 2002 the principle of integrating a PzH 2000 155mm turret on a F124 platform was demonstrated**
- **This preliminary integration was only a six weeks effort**
- **German MoD and Navy immediately started the initiative to actively support the MONARC program**
- **More detailed analysis independent of F124 program was performed early in 2003**
- **Land based firing tests took place in June 2003 and validated the integration concept**
- **A German User Requirement Document on Naval Fire Support will be established in 2004**

Next steps



- Adapt the gun for engagement of moving targets from a moving platform
- Validate the ammunition transport on moving platforms
- Substantiate these results in firing tests on board